

compression sclerotherapy is suitable for tributaries of the saphenous vein, reticular veins, venules and telangiectasias. When it is performed on large saphenous tributaries and even incompetent saphenous trunks, it is effective at reducing the size and the symptoms of these veins. By itself it is unlikely to control major trunkal incompetence long-term. Sclerotherapists have used improved diagnostic imaging with duplex scanning to improve the placement of their needles under ultrasound control. In so doing, they are cannulating bigger and bigger vessels, but they still need large volumes of high concentration sclerosant to effectively do any damage, mostly thrombosis possibly sclerosis, to these large vessels. I am speaking specifically here of the long saphenous and short saphenous trunks. This technique of ultrasound guided sclerotherapy, particularly to the saphenofemoral junction manages to temporarily occlude or cork this junction, taking the pressure off the varicosities distally. Subsequent sclerotherapy to large veins distally when the pressure is reduced will have a beneficial effect. On some available data, the recanalisation rate of the long saphenous vein at two years is over 40% and so the veins begin to re-open even in the best of hands and the process has to be repeated. It is my strong contention that these major trunks are best dealt with surgically, with high ligation and limited stripping, and at the same time surgically removing the larger varicosities, and thus saving the sclerotherapy for residual and recurrent veins.

Ideal sclerotherapy must use what you regard as the ideal solution. In Australia from 1991 to 1995 we performed an open clinical trial in an effort to introduce aethoxysklerol into the country, comparing it with the two established solutions of sodium tetradecyl sulphate and hypertonic saline (20%). The trial included 120 doctors who were experienced injectors, and a series of 34,878 legs that were injected, 40% principally for varicose veins, and 60% for surface or spider veins. The results of that trial showed most injectors to believe that aethoxysklerol had a better efficacy than the established solutions, was much less painful for the patient on injection, produced less frequent and less severe injection ulcers, pigmentation and phlebitis. The clinical occurrence of deep vein thrombosis in that trial was one leg in 7,000 injected. This has led a large proportion of Australian doctors performing sclerotherapy to chose aethoxysklerol as their preferred or best sclerosant.

We must of course compare potential complications of the two forms of treatment that we are discussing. With minimal access technique the scarring with hook phlebectomy is indeed minimal. Trauma to cutaneous nerves and subcutaneous lymphatics is certainly possible but rare and with experience of this technique can be avoided. When looking at sclerotherapy, even using one's ideal solution, the problem of retained blood in the vein, thromboembolism, toxicity of the sclerosant, telangiectatic matting and injection ulceration remain possible, but again with a low incidence.

As individual doctors practising on their patients daily, we encounter many variables that go into our decision to advise the patient to have one treatment or the other. As far as the treating doctor is concerned, he may have very little time available and it is obvious that the surgical removal of veins takes longer, but he is rewarded proportionally to his time expended and so the cost is higher. If he is a sclerotherapist or physician who is not used to actually making incisions and pulling things out then this may influence him towards sclerotherapy, but if he is a surgeon who finds hook phlebectomy

quick, easy and satisfying then this direction may be followed. The doctor's access to facilities and equipment is also a vital factor. The patient also presents variables in the eventual decision and sometimes they demand one way and one way only to be treated. The level of financial remuneration governed by their level of medical insurance is also going to be a factor, but what is a very important clinical factor is the site of the veins on the legs and over any difficult site surgical excision of raised palpable veins in my opinion does a lot better than sclerotherapy.

And so ambulatory venous surgery can be used on saphenous trunks, major saphenous tributaries and large reticular veins. It is more time consuming than sclerotherapy, but one treatment is all that is required to remove the particular vein. Compression following ambulatory venous surgery need only be for 48 hours and there is a very low medium term recurrence rate with very good patient satisfaction. Pigmentation, ulceration and phlebitis do not occur after this technique. Sclerotherapy, looking at the same parameters, can be used on large and small veins alike from saphenous trunks all the way down to telangiectasias. It is a much quicker technique to perform than ambulatory venous surgery, but often requires multiple treatments and longer compression, depending on the size of the vein, up to six weeks. There is a variable medium term recurrence rate and variable patient satisfaction. When high volumes of high concentration sclerosant are used this has more chance of leading to pigmentation, ulceration or phlebitis.

In summary it is my contention that using the best available minimally invasive ambulatory venous surgery for the larger vessels that are raised and easily removed should then be followed by sclerotherapy, using the best sclerosant available to you, and I consider that to be aethoxysklerol. This will yield your best results. Ambulatory venous surgery versus sclerotherapy therefore should now read ambulatory venous surgery followed by sclerotherapy for best results.

NEW TRENDS AND OPERATIVE TECHNIQUES IN THE MANAGEMENT OF VARICOSE VEINS

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The advances in noninvasive diagnostic vascular technology have allowed us to study with accuracy the anatomy and pathophysiology of the venous system. With the use of the bi-directional Doppler, color-flow duplex scanner, and air plethysmography, we can investigate the venous pathology in a very precise manner and plan the appropriate treatment. As a result of these technological advances, we have learned that the main trunk of the saphenous vein may be quite healthy despite the presence of large clusters of varicose veins in one or more of its tributaries. Sparing a healthy saphenous trunk has become of importance for two main reasons: the first reason is that it makes no sense to excise a healthy organ that is performing its assigned function in a satisfactory manner.¹ The second reason is that the saphenous vein is the most important autogenous conduit utilized as bypass, patch, or substitute in the arterial system.

Despite these reasons, surgery for primary varicose veins with preservation of the saphenous trunk is controversial. There are several published reports that support sparing the saphenous vein. Large¹ studied 202 patients in whom he performed stab avulsion and proximal ligation only in cases of sapheno-femoral incompetence (51.5%). There was a 10.5% recurrence rate at three years. Hanrahan, et al,² performed duplex examination of 54 lower extremities with varicose veins. Seventy-two percent of these patients manifested branch incompetence alone. The relationship of incompetence of the sapheno-femoral junction to the presence of superficial varices was inconsistent. Deep venous incompetence was present in 41% of the extremities. These data support the position that the preoperative assessment of reflux in vein segments is more appropriate than routine stripping of the main trunk or ligation of the sapheno-femoral junction. Koyano and Sakaguchi³ studied 337 legs of 208 patients using Doppler and calf compression-release. They found that 66% of these patients had incompetence of the long saphenous vein. They were able to demonstrate reflux in segments of the saphenous vein. Based on Doppler findings, they performed selective stripping in 80 limbs in which only the segments with venous reverse flow were selectively removed. Their follow-up studies showed that selective stripping operations were as satisfactory as those in which the standard stripping operation was carried out (189 limbs). Additionally, the incidence of saphenous neuritis was 4.8% in patients with selective stripping versus 27% in patients submitted to full stripping.

Other studies have challenged the preservation of the saphenous vein. Munn, et al,⁴ reported that routine greater saphenous vein stripping had a lower incidence of recurrent varicosities (18%) than was seen in patients in whom the saphenous vein was preserved (29% recurrence). Of interest, however, was the finding that the patients were more satisfied with the results of the leg that was not stripped. This was the result of a high incidence of nerve injuries in the legs which had full stripping.

Sutton and Darke⁵ performed peri-operative retrograde saphenography to study 80 incompetent long saphenous veins in 60 patients with primary varicose veins. They found that there were varicose changes in 65% of the greater saphenous veins and stated that the incompetent vein did not appear to be a suitable arterial replacement. They concluded that insufficiency of the saphenous valves may contribute to the development of venous ulceration. In these studies, Hunterian perforators of variable size were seen on 70 saphenograms (87%) and these investigators concluded that stripping of the incompetent greater saphenous vein would certainly disconnect such perforators and reduce the incidence of both recurrent varicose veins and persistent ulceration. The diagnosis of saphenous incompetence was performed with Doppler and Valsalva maneuver and confirmed by intra-operative phlebography.

MacFarlane, et al⁶ performed phlebography in 35 extremities that were going to be operated on for varicose veins. They demonstrated that the segment of saphenous vein below the knee does not undergo varicose dilatation. In seven of nine patients examined post-operatively, the segment remained patent after the vein above had been stripped. Additionally, 75% of the greater saphenous veins above the knee were not dilated or tortuous. These authors concluded that varicose veins resulting from sapheno-femoral incompetence can be treated surgically by stripping the long saphenous

vein only to the knee and yet still leave a non-varicose segment for possible future utilization. In 75% of their cases, the greater saphenous vein above the knee was incompetent, but not grossly dilated or tortuous. In the remaining 25%, the above knee portion was severely diseased and would have been unsuitable for any form of bypass grafting.

McMullin, et al,⁷ studied 54 limbs with duplex scanning before high ligation and multiple avulsion of primary varicose veins. Duplex scanning confirmed sapheno-femoral incompetence and excluded short saphenous incompetence. Of interest is that in 24 of the 52 limbs in which the junction had been ligated, there was persistent reflux down the long saphenous vein. In only two limbs was this reflux attributable to mid-thigh perforating veins. Photoplethysmography was performed before and after surgery and the venous refilling time measured. Using this method to evaluate results, the authors concluded that high ligation without stripping fails to control significant reflux within the long saphenous vein in a high proportion of cases. However, van Bemmelen and Strandness,^{8,9} by applying graded pressure in a cuff placed proximal to the valve segment investigated, have shown that a velocity exceeding 30 cm/sec is necessary to prompt the normal valve to close. With velocities lower than this, the valves will not regularly close and reflux can persist, giving a false impression of the status of the valves in question. After ligation of the sapheno-femoral junction, there is not enough pressure or sufficient blood velocity to close the valves below the junction. For this reason, trunk reflux may be detected by color duplex scanning after compression-release at the calf.

At our institution, patients who are going to be submitted to varicose vein surgery for primary venous insufficiency have examination of their saphenous system by duplex scanning in the upright position before surgery. The saphenous diameter is measured at the femoral junction, and upper, middle, and distal thirds of the thigh. Depending on the height and weight of the individual, saphenous veins which were found dilated, tortuous, and irregular, and which demonstrate reflux, are routinely stripped from groin to just below the knee (Fig. 25.1). However, a saphenous vein trunk of normal size, which tapers down uniformly without tortuosity or aneurysmal dilatations, is preserved.

Even though there is evidence in the literature and in our clinical experience that the saphenous vein can be spared in those cases of patients with varicose veins in whom the saphenous trunk is found to be healthy, the definitive answer to the controversy of stripping the saphenous trunk or preserving it in a selective manner must await prospective randomized studies using duplex scanning and air plethysmography to evaluate long-term results. The diameter of the vein at different levels and the soundness of the trunk are considered in the randomization to strip or to preserve.

Another method of achieving competence of the sapheno-femoral junction in patients with varicose veins has been the application of venous cuffs at the first centimeter of the sapheno-femoral junction. The cuff is tightened until competence is achieved. The cuffs are made of Dacron or other prosthetic materials. Again, long-term results in a sizable sample of patients with hemodynamic information are lacking. Besides, the insertion of prosthetic material in young individuals, which form the majority of patients with primary varicose veins, is costly and, in our opinion, not justifiable.

Varicose Vein Surgery in a Bloodless Field

During the last three decades, we have learned to appreciate the benefits of a bloodless field as practiced by the orthopaedic, plastic and cardiac surgeons. In vascular surgery, the pneumatic tourniquet has been utilized to avoid clamping calcified vessels during the performance of distal anastomosis in bypass surgery. We have used the pneumatic tourniquet extensively during the resection of hemangiomas and other vascular malformations in patients with congenital vascular anomalies. More recently, the pneumatic tourniquet has been utilized to render a bloodless field during the endoscopic subfascial ligation of perforators. At our institution, we have used the pneumatic tourniquet in patients with extensive and grossly dilated varicose veins. In the past, patients with extensive varicose veins occupied several hours of our operating time. The introduction of the tourniquet has dramatically reduced the operating time and has allowed us to perform a complete removal of all varicosities without blood loss. The technique consists of exposure of the sapheno-femoral junction before applying the tourniquet. After division of the saphenous vein, in those cases in which stripping is to be performed, a flexible stripper is introduced through a small incision below the knee and retrieved at the groin. The vein is prepared for invaginated stripping, and the inguinal wound is closed in layers. A pneumatic tourniquet is applied at the upper thigh after wrapping the leg tightly with an Esmarch rubber bandage. The tourniquet is inflated at 300 mmHg and the operation can then be performed in a bloodless field. In 78 patients with extensive varicose veins and 97 congenital vascular anomalies operated upon, the average operating time has been 55 minutes (range: 45-80 minutes). When necessary, stripping is performed with the tourniquet inflated. The vein stripper slides easily under the tourniquet. The wounds are usually closed with steri strips, the extremity is carefully padded and a compression bandage applied. The patient remains in the hospital for a few hours and goes home during the late afternoon.

Ambulatory Venous Surgery

Ambulatory venous surgery has been practiced for many years. In 1930, De Takats¹⁰ published his experiences with this technique. Nabatoff,¹¹ in 1972, described his method of complete stripping of the varicose veins as an outpatient procedure. The competition for hospital beds, the long waiting lists for varicose vein surgery and financial considerations have stimulated surgeons to seek options to operate as many cases as possible without compromising the hospital capacity. There are numerous reports in the literature dealing with this subject.¹²⁻¹⁶ In a recent publication, Baccaglini, et al,¹⁷ conducted a multicenter trial in 2568 extremities with varicose veins. Different anesthesia techniques were utilized (local, spinal, general, and local plus sedation). Post-operative hospitalization was required in only two cases. Post-operative complications included headache after spinal anesthesia and residual paraesthesia after femoral nerve block. The consensus of surgeons participating in this protocol confirms that surgery of varicose veins can be carried out on an outpatient basis with similar complications as observed in hospitalized patients. The authors conclude that outpatient surgery is cost-effective and diminishes the demand for hospital beds, while assuring that the quality of patient care is maintained.

Crochet-hook Vein Excision

In 1957, Thomas T. Myers, of the Mayo Clinic, reported that extensive removal of all varicosities, followed by ligation and stripping of the greater and lesser saphenous veins, was accompanied by 85% good-to-excellent results at 10 years. Since then, many thousands of patients throughout the world have been submitted to this procedure. The extensive scarring of the operation and the length and tediousness of the procedure have prompted the surgical community to seek new avenues of treatment for varicose veins. In 1975, Rivlin¹⁸ reported the use of mini-incisions and fine pointed forceps for the extraction of the varicose tributaries of the saphenous vein. Since then, the method of stab avulsion through mini-incisions has been extensively practiced throughout the world. Special hooks have been developed by Müller,^{12,13} Oesch,¹⁴ Varady,¹⁹ and Villavicencio.²⁰ The technique of stab avulsion phlebectomy has been used extensively over the last 20 years by Villavicencio. A set of specially designed hooks has been routinely utilized in every case of varicose vein surgery during the last 14 years.

Technique

With the patient in the upright position and the extremity shaved, the varicose veins are marked with indelible ink. The operating surgeon should mark the patient. The extremity is placed in the Trendelenburg position, and the crochet hook phlebectomy is performed through 2-3 mm incisions done with a number 11 scalpel blade. Incisions must be made parallel to the axis of the vein to prevent piercing it. The hook is introduced with its flat side under the vein. Once the tip of the hook has passed on the other side of the vein, it is rotated so its tip is pointing toward the skin. At this point, it is pulled back, lifting the hooked vein while counter-pressure is applied over the skin. A loop of vein is exteriorized by pulling gently. The maneuver is repeated through several incisions placed along the course of the vein until the complete venous segment has been excised. Incisions are placed approximately 1-2 inches apart, and at the end of the procedure are closed with steri-strips. Compression pads are placed over the wound and the extremity is wrapped with a thick roll of gauze and a firm elastic bandage. The small incisions heal uneventfully and are practically invisible after several months.

In summary, great advances have occurred in the management of venous disorders. The surgical management of varicose veins is more objective and based on sound hemodynamic and anatomic principles. However, the most important aspect of this progress is its continuous evolution. Research protocols are in progress to solve some of the most important problems in the management of these diseases. This is an exciting time in which technological advances have provided the necessary tools for sound investigation.

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CASE OF SUPERFICIAL INCOMPETENCE

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Large Recurrent Circumferential Ulcer Due to Primary Incompetence of Long Saphenous Vein (Possibly Perforators) with Competent Deep Venous System

A 65-year old lady from the Big Island of Hawaii, who works in a coffee plantation and has 5 children, developed increasing varicose veins during the pregnancies. She has no previous history of DVT. Thirty years ago, in the end of the 60's she developed the first ulceration of the right leg. It developed gradually into a circumferential ulceration and amputation of the leg was recommended. In 1972, Dr. Yee in Honolulu operated on the patient with skin grafting and the ulcer remained healed for several years. Since the beginning of the 80's she has had several recurrences but never sought medical advice due to the previous threat of amputation. Since the beginning of the 90's the ulcer never healed and has developed into a large painful circumferential ulceration that she was treating with local herbs without compression. Because of the pain she again consulted Dr. Yee in November 1995 and she was referred to the vascular service at Straub in Honolulu.

At admission she had a circumferential, granulating ulceration at the lower part of the right leg with a length of 12 cm (Fig. 1). Cultures showed growth of staphylococcus and pseudomonas. She had normal pulses in the posterior tibial and dorsalis pedis arteries. Hand-held Doppler examination showed severe reflux of the long saphenous vein with competent deep veins.

Duplex scanning of the veins showed patent and competent deep venous system. There was severe reflux of the long saphenous vein which communicated with the short saphenous vein through a Giacomini communicator. SSV was competent. There were no incompetent perforators, but the area under the large ulceration could not be studied. Ascending venography showed no obstruction and no signs of previous DVT; the deep veins as well as the long saphenous vein were widely patent; there were several perforators

between the posterior tibial vein and the long saphenous vein (incompetent?)

Descending venography of the right leg through catheterization of the left femoral vein showed grade 4 reflux of the long saphenous vein. The deep femoral vein was competent and there was a slight grade 2 reflux of the proximal superficial femoral valve (Fig. 2).

CEAP CLASSIFICATION: C2,3,4,5,6s; Ep; As; Pr2,3

Figure 1.— 65 year old woman at admission with a circumferential granulating ulceration of the right leg with a length of 12 cm.



(Figures 2 & 3 on the next page)

DISCUSSION

DR. O'DONNELL: I think everybody agrees that ligation and stripping is most appropriate. What isn't settled is whether the perforators should be treated. I found it fascinating that we have a new anatomical finding that the perforators are now related to the long saphenous vein! The questions are: 1) do you treat the perforators at this time? And (2) how do you treat the basic lesion, the skin ulcer? Dr. Raju, would you place a skin graft on this ulcer at the same time or leave it alone?

DR. RAJU: I think I would just strip the saphenous vein and skin graft the ulcer at the same time. However, our practice has been altered a little bit in recent years simply because the gatekeepers don't allow us to pre-admit these patients. There is no luxury of admitting these patients for a week and give them antibiotics even though you can do it with a great deal of effort. We just admit them in the morning unless the patient is septic. If the wound is reasonably clean, we proceed and have even done deep venous reconstruction under those circumstances. Even though you would think that the incidence of infection would be high, it is not very different from